

**Oroville Facilities Relicensing Efforts  
Environmental Work Group  
Draft Narrative Reports for Resource Action Discussion**

**Resource Action:** EWG-99

**Task Force Recommendation Category:** 2

**Proposed Enhancement of Side Channels for Salmonid Spawning and Rearing  
Habitat in the Feather River between Oroville Dam and Honcut Creek**

**Date of Field Evaluations:** November 6, 2003 and January 22, 2004

**Evaluation Team:** November 6: Koll Buer, Eric See, Jason Kindopp, Richard Harris, Bruce Ross, and Michael Manwaring; January 22: Jason Kindopp, Ryon Kurth, Michael Manwaring.

**Description of Potential Resource Action Measure:**

This Resource Action would be designed to create or enhance side channels, within existing levees, to increase spawning and rearing habitat for spring-run Chinook and steelhead. The location(s) for implementing this measure could be anywhere on the Feather River between Oroville Dam and Honcut Creek. If required, water could be provided to the created or enhanced habitat through increased instream flows or by other means such as conduits from project waters.

Potential sites for side channel creation and enhancement were evaluated as part of site visits conducted on November 6, 2003 and January 22, 2004 with DWR and consultant staff. Seven potentially suitable side channel locations were investigated via field visits. Four additional locations were included based on previous observations. Several additional sites in the Low Flow Channel (LFC) reach were previously investigated in the evaluations for EWG-16A and EWG-16B. The reader is referred to the narrative reports on those measures for discussion of those sites. The focus of this narrative report and EWG-99 is on the Feather River between the Thermalito Outfall and Honcut Creek.

**Related Resource Actions:**

There are several other Resource Actions that are either similar to or otherwise related to this measure:

- EWG-13A/20 and EWG-13B propose to improve rearing habitat through placement of wood and other materials in the LFC and High Flow Channel (HFC) of the lower Feather River.
- EWG-16A and EWG-16B propose to create or enhance side channel habitat in the LFC.
- EWG-98 would involve creating or enhancing spawning and rearing habitats in tributaries to the Feather River below Oroville Dam.

**Nexus to the Project:**

Many factors, including flood control levees, construction of the dam at Lake Oroville, historic land use activities (hydraulic mining), and regulation of stream flows have

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cumulatively caused changes to the geomorphology and substrate in the Feather River system. The cumulative impacts of these changes have generally reduced the availability (quantity and quality) of spawning and rearing habitat for anadromous fishes. It is believed that because of reduced habitat quality and quantity, the productivity of the naturally spawning Feather River anadromous salmonid fishery has been reduced.

**Potential Environmental Benefits:**

The most immediate potential benefit of the proposed Resource Action would be an increase in the available spawning and rearing habitat for Central Valley steelhead and Central Valley spring-run Chinook salmon, both listed as threatened species under the Federal Endangered Species Act. Fall-run Chinook salmon and other native fishes would also benefit. Ultimately, improvements in habitat should result in improved fish production and adult escapement.

**Potential Constraints:**

Constraints on this measure are both general and site-specific. An overriding constraint is availability of funding to carry out stream habitat restoration projects. However, all of the sites investigated already possess some of the required characteristics of side channel habitat. Consequently, major geomorphic reconstruction would not be required. Instead, limited geomorphic reconstruction along with minor improvements to riparian and physical habitat would be implemented.

A second general constraint is the availability of water. Without adequate, dependable water sources during low flow conditions, habitat improvements would have little functional value. However, since all potential enhancement sites are currently connected to the Feather River or are feasibly reconnected to it, provision of water would not be a major problem. The source of water would be streamflow releases from Lake Oroville or Thermalito Outfall. Table 1 (below) lists each location, the types of activities expected as a result of the project, and an estimation of the amount of potential habitat gained from the action.

The third and arguably most important constraint to successfully implementing this or similar Resource Actions is water temperature. If daily mean temperatures of 65 degrees Fahrenheit are not achieved during the summer rearing period, increased side channel habitat will have significantly less value.

**Existing Conditions in the Proposed Resource Action Implementation Area:**

It is generally understood that availability of spawning and rearing habitat for steelhead and spring-run Chinook are limiting factors for production of anadromous salmonids in the Feather River below Oroville Dam. In part, this is due to the regulated flow regime and trapping of sediment behind the dam. The available habitat is utilized by salmon and steelhead for spawning, but only transitionally for rearing. Additional habitat would undoubtedly be utilized for spawning and rearing if it were made available. Rather than evaluating the possibilities for creating entirely new habitats, the focus of this evaluation

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was on locations with existing habitat values that could be easily improved with minor geomorphic work and additional flows.

There are several locations within the Feather River corridor below the Thermalito Outfall that already possess many required characteristics of side channel habitats. Seven of these were inspected in the field. Four others were identified based on previous observations. Table 1 lists the basic elements for each site. The general characteristics evaluated at each site were:

- Length, area and slope
- Connectivity to the Feather River
- Nearby instream habitat conditions
- Riparian habitat conditions
- Proximity to spawning habitat
- Existing streamflow
- Required streamflow
- Current temperature regime

**Design Considerations and Evaluation:**

This Resource Action only addresses side channels that would maintain approximately 15-50 cfs. Larger, in-channel projects should be addressed in a separate Resource Action (possibly EWG-93A or EWG-93B). Researchers should study all possible combinations of side-channel restoration in the LFC and the HFC down to Honcut Creek. (Note: side channel improvements in the LFC are discussed in the narrative reports for EWG-16A and EWG-16B.)

Although other, more effective designs may surface during more critical site visits, a typical design concept could include the following. A header box and stop log structure would be needed to control flow at the upstream end of each channel. This flow control device would be designed to allow for some degree of manipulation, but would not severely restrict upstream passage of adult anadromous migrants or cause injury to any downstream migrants.

To ensure that these channels do not trap fish during flow decreases, a rating curve should be developed yearly for each channel using the normal gate setting. This curve will relate Thermalito Dam and Thermalito Outfall releases to the approximate flow in each channel. If necessary, personnel can be dispatched to modify stop log adjustments to maintain a preferred range of flows.

Alternatively, side channel design and construction could be more typical of natural flow regimes. For example, each channel could be constructed to naturally maintain prescribed flows at minimum discharge into the HFC. This will allow for steelhead and Chinook to find quality spawning and rearing habitat during even the lowest flow releases. Flood events will undoubtedly alter the original design of each channel. However, allowing the river to manipulate the channel would likely result in a more

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natural system that fish are more likely to accept. Certainly, maintenance will be required of any stream channel modification or enhancement. However, enhancing existing side channel locations (geomorphically and with flow increases) that are currently inundated at higher flows, should improve long-term success.

The flow for each side channel should provide the preferred water depths and velocities for various life stages of salmonids. The channels would likely have to be reformed by mechanical means, using a backhoe with non-toxic lubricants in sensitive areas if necessary. Some natural riparian vegetation would need to be planted, although many potential sites already maintain adequate amounts of vegetation. In many cases, rock and woody debris would need to be re-positioned.

Improvements to side channels may require permits or clearances from the Department of Fish and Game, NOAA-Fisheries, the US Fish and Wildlife Service, the US Army Corps of Engineers, and/or the State Regional Water Quality Control Board.

Methods for assessing the effectiveness of habitat improvements could include monitoring of fish use and production. Habitat improvements would likely be impacted in indeterminate ways by future peak flood events. If adversely affected by floods, side channel reconstruction might be necessary.

**Synergisms and Conflicts:**

This Resource Action would likely be a significant component of a strategy aimed at improving the natural production of anadromous salmonids in the Feather River. It is compatible and synergistic with other efforts to improve spawning and rearing habitat in the LFC. The main potential conflict with this measure is the demand for appropriate water temperatures during the summer.

**Uncertainties:**

Because this evaluation has focused on locations where conditions are already at least partially suitable for side channel enhancement, some uncertainties that would be associated with habitat creation are avoided. Probably the greatest uncertainty is in the premise that if the habitat is improved, that fish production will increase.

**Cost Estimate:**

Costs for side channel habitat improvements would vary by site. Some general costs for instream habitat improvements (e.g., structural placements, substrate enhancements, etc.) would be on the order of several thousand dollars. Costs for riparian vegetation enhancement (e.g., bioengineering, planting, etc.) would be on the same order of magnitude.

**Recommendations:**

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It is recommended that the side channel enhancements suggested in this narrative report be considered as an appropriate measure for increasing spawning and rearing habitat for Central Valley steelhead and Central Valley spring-run Chinook salmon. Further direction should be provided by the EWG Collaborative on whether or not to refine the attached list of proposed sites (Table 1) to identify one or two locations for experimental construction. The attached Figure 1 shows an example location proposed for side channel enhancement (Lower Hour Riffle). If an initial site location chosen for enhancement is completed, monitored, and evaluated, additional side channel enhancements could be phased in over time (i.e., within the new license period).

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**Table 1. EWG-99: Potential HFC Side Channel Locations between Thermalito Afterbay Outlet and Honcut Creek.**

<b>Proposed Location</b>	<b>River Mile (RM)</b>	<b>Targeted Species</b>	<b>Current Temperature Suitability</b>	<b>Targeted Activity</b>	<b>Approximate Side Channel Flow (cfs)</b>	<b>Approximate Channel Length in meters/miles</b>	<b>% Additional Habitat of this type created (HFC only/ LFC+HFC combined)</b>	<b>New Channel or Manipulation of Existing Channel</b>	<b>Additional Benefits of Permanent Channel</b>	<b>Most Critical Component</b>
Big Hole Island	58.0	CVSR/CVFR/Steelhead	Adequate	Rearing	15	290/0.18	236%/21%	Manipulation	Prevent Stranding	Temperature
Lower Hour Riffle	56.4	CVSR/CVFR/Steelhead	Poor	Spawning/Rearing	40	386/0.24	314%/26%	New	Prevent Stranding	Temperature
Hour Bars	55.9	CVSR/CVFR/Steelhead	Poor	Spawning/Rearing	25	354/0.22	288%/24%	Manipulation	Prevent Stranding	Temperature
Keister	55.0	CVSR/CVFR/Steelhead	Poor	Spawning/Rearing	20	290/0.18	236%/21%	Manipulation	Prevent Stranding	Temperature
Goose	54.8	CVSR/CVFR/Steelhead	Poor	Spawning/Rearing	40	580/0.36	472%/39%	Manipulation	Prevent Stranding	Temperature
Big Bar	53.4	CVSR/CVFR/Steelhead	Poor	Spawning/Rearing	25	290/0.18	236%/21%	Manipulation	Prevent Stranding	Temperature
MacFarland	52.5	CVSR/CVFR/Steelhead	Poor	Spawning/Rearing	50	193/0.12	157%/14%	Manipulation	Prevent Stranding	Temperature
Gridley1	49.7	CVSR/CVFR/Steelhead	Poor	Spawning/Rearing	25	419/0.26	341%/28%	Manipulation	Prevent Stranding	Temperature
Gridley2	49.3	CVSR/CVFR/Steelhead	Poor	Spawning/Rearing	40	580/0.36	472%/39%	Manipulation	Prevent Stranding	Temperature
Herringer1	46.3	CVSR/CVFR	Good	Rearing	50	580/0.37	472%/39%	Manipulation	Prevent Stranding	Temperature
Herringer2	46.1	CVSR/CVFR	Good	Rearing	50	515/0.32	419%/34%	Manipulation	Prevent Stranding	Temperature

Totals

4477/2.78

3643%/306%

Thermalito Afterbay Outlet is RM 59; Honcut Creek is RM 44.

CVSR: Central Valley Spring-run; CVFR: Central Valley Fall-run.

% Additional Habitat Created: This is the amount of additional side channel habitat that would be created if the project was enacted. For example, if the Big Hole Island project were completed, it would create approximately 236% more of this type of habitat compared to what currently exists in the HFC and 21% more of this type of habitat compared to the HFC and LFC combined.

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Figure 1. Proposed Side Channel Restoration Site. Lower Hour Riffle (RM 56.4)

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**Resource Action: EWG-45**

**Task Force Recommendation Category: 2**

**Create Trophy Salmonid Stocking Program in Thermalito Afterbay**

**Date of Field Evaluation:** No field evaluation was conducted

**Evaluation Team:** Phil Unger and David Sun

**Related Resource Actions:**

There are several other Resource Actions that are either similar to or otherwise related to this measure:

- EWG-47, that proposes to create trout stocking program in suitable Oroville Wildlife Area ponds.
- EWG-48, that would create trophy angling areas in selected Oroville Wildlife Area ponds by stocking warm water species (e.g., Florida strain bass).
- EWG-50, that proposes to continue the management protocols for the coldwater fishery in Lake Oroville.
- EWG-78A, that would develop maintenance and recreational management actions to avoid impact to special status species within the project area.
- EWG-87, that proposes to operate or modify the Oroville Complex in a manner that would provide suitable warm water for agricultural and recreational purposes, while providing adequate coldwater releases at the Thermalito Afterbay Outlet.

**Description of Potential Resource Action Measure:**

This measure would create a steelhead stocking program in Thermalito Afterbay, similar to the trophy salmonid program in Lake Oroville. The intention is to use a native Feather River strain of steelhead that would be resistant to local fish diseases. The stocking program would enhance the sport fishery, which would potentially increase recreational opportunities in the Afterbay.

**Nexus to the Project:**

The Oroville Project operations control the flow of water from Lake Oroville to the lower Feather River through diversions through and around Project facilities, including the Thermalito Complex (Forebay and Afterbay). As part of the Project operations, DWR and the California Department of Fish and Game (DFG) currently maintain a cold water fishery in Lake Oroville. This Resource Action would be designed to expand that managed fishery program to include a cold water fishery (i.e., stocking salmonids) in the Thermalito Afterbay. The construction of the Oroville Facilities has created a number of new recreational opportunities, and this resource action would provide additional trophy angling opportunities that would otherwise not exist.

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**Potential Environmental Benefits:**

A properly managed stocking program would potentially reduce angling pressure on native fish stocks within the project area and thereby improve native fish production.

The proposed stocking program intends to use a Feather River strain of steelhead to minimize disease concerns. It is expected a native strain of steelhead would have higher resistance to local diseases than an exotic strain. This assumption would need to be confirmed with staff at the Feather River Fish Hatchery.

**Potential Constraints:**

Water temperatures in the Thermalito Afterbay are a major potential constraint on establishing a steelhead stocking program because it is unknown how long steelhead would survive in the warm summer temperatures that prevail in most of the Afterbay. It is likely, however, that temperatures in the central deep channel of the Afterbay would be suitable for the steelhead. Additional potential constraints may arise from fish diseases, as well as impacts on native fishes. It may be difficult to find a suitable fish stock that is not only a desirable sport fish, but is also resistant to significant fish diseases, such as salmonid ceratomyxosis (*Ceratomyxa shasta*) and infectious haematopoietic necrosis (IHN). In addition, stocked fish escaping into the lower river through Thermalito Afterbay Outlet could have impacts on sensitive native species in the Feather River, due to competition and/or predation.

**Existing Conditions in the Proposed Resource Action Implementation Area:**

The Thermalito Afterbay is located downstream of the Thermalito Forebay, which is located downstream of the Thermalito Diversion Pool and Oroville Reservoir. Water from the Afterbay is released through the Thermalito Afterbay Outlet into the Feather River downstream of the Low Flow Channel. Some Afterbay water is also diverted into irrigation canals. The Afterbay provides storage for the pump-back operation to Lake Oroville. The facility also provides recreational opportunities and provides agricultural water for several local irrigation districts. The water surface area of the facility at maximum operating storage is approximately 4,300 acres.

The Thermalito Afterbay has a diverse water temperature regime. During the warmer times of year, water temperature released from the Afterbay to the Feather River is warmer than that already in the river because the water diverted through the Thermalito Complex has a much longer residence time, including time in shallow reservoirs, than the water in the Low Flow Channel. Water temperature in the Afterbay is constrained during summer and fall by low water temperature objectives for fish in the Feather River downstream of the Afterbay outlet, and during spring by elevated water temperature objectives for rice farmers. The combination of cold inflowing water and large areas of shallow water results in a wide range of water temperatures within the Thermalito Afterbay, thus providing suitable habitat for both warmwater and coldwater fish species. Limited fish sampling at the facility has found mostly warmwater fish species, but some cold water species (i.e., rainbow trout and brown trout) have also been found. Currently, a popular largemouth bass fishery exists in the Thermalito Afterbay and there

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is no salmonid stocking program. However, coldwater species are stocked into the Thermalito Forebay, and it is likely that fish from the Thermalito Forebay pass through the Thermalito Pumping Generating Plant into the Afterbay.

The two most significant diseases in the project waters are ceratomyxosis and IHN, which both only affect salmonids. These diseases have been reported from the Thermalito Annex Fish Facility. However, the higher water temperature in the facility is believed to slow the spread of IHN since the disease is more problematic at lower water temperatures.

**Design Considerations and Evaluation:**

All stocked fish would need to be screened and properly managed for fish diseases prior to fish planting. Such actions would minimize the risk of transmitting diseases to resident fish in the Thermalito Afterbay and potentially into the Feather River.

**Synergisms and Conflicts:**

This resource action is compatible with other measures that relate to stocking programs and therefore should be managed in coordination with those other programs.

Implementing this action would potentially lead to water temperature conflicts with the warmwater sport fishery and with rice farmers.

**Uncertainties:**

A major uncertainty is the potential impacts of a steelhead stocking program on resident fish in the Afterbay and TES and other species in the Feather River. For instance, steelhead predation on juvenile salmon has been identified as a potential issue with regard to production of wild spring and fall-run Chinook salmon in the Feather River (EWG-42).

**Cost Estimate:**

The stocking goals need to be established before the cost can be estimated. Once these goals have been determined, the cost for this measure could be estimated from existing hatchery stocking programs and could ultimately be integrated into the existing programs.

**Recommendations:**

This resource action would require proper management to avoid any impact to the existing fisheries. All stocked fish would need to be screened for fish diseases to prevent disease transmission to fishes in the Thermalito Afterbay and, potentially, the Feather River.

If possible, measures should be included with this action to prevent/reduce downstream passage of planted fish from the Thermalito Afterbay into the Feather River.

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**Resource Action: EWG-47**

**Task Force Recommendation Category: 2**

**Create Trout Stocking Program in Suitable Oroville Wildlife Area (OWA) Ponds**

**Date of Field Evaluation:** No field evaluation was conducted

**Evaluation Team:** Eric See, with Phil Unger and David Sun

**Description of Potential Resource Action Measure:**

This measure would create a trout stocking program (put and take) in suitable Oroville Wildlife Area (OWA) ponds. The stocking program would enhance the sport fishery, which would potentially increase recreational opportunities. The potential risk of introduced fish diseases is expected to be minimal since most planted fish would not be expected to survive when ponds warm up in the summer.

**Related Resource Actions:**

There are several other Resource Actions that are either similar to or otherwise related to this measure:

- EWG-45, that proposes to create a trophy salmonid stocking program in Thermalito Afterbay.
- EWG-48, that proposes to create trophy angling areas in selected Oroville Wildlife Area ponds by stocking warm water species (e.g., Florida strain bass).
- EWG-50, that proposes to continue the management protocols for the cold water fishery in Lake Oroville.
- EWG-78A, that would develop maintenance and recreational management actions to avoid impact to special status species within the project area.
- EWG-87, that proposes to operate or modify the Oroville Complex in a manner that would provide suitable warm water for agricultural and recreational purposes, while providing adequate cold water releases at the Thermalito Afterbay Outlet.

**Nexus to the Project:**

The OWA ponds were created during construction of Oroville Dam and other Oroville facilities as borrow sites for gravel. The lower Feather River is hydrologically connected to many of the OWA ponds, and many have been designed to flood at high flows to reduce downstream flooding effects. DFG currently manages the OWA primarily for wildlife habitat and recreational activities. This resource action would be designed to enhance existing sport fishery by providing additional trophy angling opportunities that would otherwise not exist. In addition, this measure would potentially reduce fishing pressure within the Project area on Central Valley steelhead and Central Valley spring-run Chinook salmon, both listed as threatened species under the Federal Endangered Species Act.

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**Potential Environmental Benefits:**

A properly managed trout stocking program would potentially reduce angling pressure on native salmonid fish stocks within the project area and would thereby improve native salmonid fish production.

**Potential Constraints:**

Water temperatures in OWA ponds are a major potential constraint on establishing a trout stocking program because it is unknown how long the stocked trout would survive in the warm summer temperatures that prevail in most of the OWA ponds. If the stocked trout survive the warm temperatures, additional constraints may arise from potential escapement of stocked fish into the lower river during flooding events, which may potentially impact Central Valley steelhead and Central Valley spring-run Chinook salmon in the Feather River. The impact of fish escapement may also include the potential risk of disease introduction.

**Existing Conditions in the Proposed Resource Action Implementation Area:**

The OWA is situated near Feather River downstream of the Oroville Reservoir. It is comprised of approximately 11,000-acres, and is primarily managed by DFG for wildlife habitat and recreational activities. The area encompasses over 75 warm water ponds and sloughs, along with large areas of emergent marsh. Warm water fish, such as bass, catfish and crappie, are abundant. The fish populations are self sustaining through natural production in the ponds and recruitment from the Feather River, which floods into the OWA ponds during high flow events.

The OWA ponds typically warm during the summer months. Most cold water fish species would not survive under this condition, and due to the fact that the most common fish diseases identified in the Feather River basin thrive in colder water, the potential risk of introducing fish diseases is anticipated to be minimal. However, if stocked fish were to survive through the summer and winter flooding created opportunities for the fish to move into the Feather River, then the potential disease introduction would be increased.

**Design Considerations and Evaluation:**

Properly managing and screening all stocked fish for fish diseases prior to fish planting would minimize disease transmission to resident fish in the OWA ponds. This effort would need coordination between the Feather River Hatchery staff and OWA staff; however, all fish being stocked under the current stocking programs are already being screen for fish diseases.

There is a need for more information on the ecological impacts of the trout stocking program on existing threatened and endangered species, such as red legged frog.

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One potential design consideration to minimize escapement of stocked fish into the lower Feather River would be to avoid stocking fish during periods when there is a significant risk of Feather River spilling into the OWA ponds.

**Synergisms and Conflicts:**

This Resource Action is compatible with other measures that relate to stocking programs and recreation enhancements, and therefore should be managed in coordination with those other programs.

**Uncertainties:**

A major uncertainty is the potential impacts of a trout stocking program on resident fish and threatened and endangered species in the OWA ponds and the Feather River.

**Cost Estimate:**

The target species and stocking goal need to be established before costs can be estimated. Once they have been determined, the cost for this measure could be estimated from existing hatchery stocking programs and could ultimately be integrated into the existing programs.

**Recommendations:**

This resource action would require proper management to avoid any impact to the existing fishery. All stocked fish would need to be screened for fish diseases to prevent disease transmission to fishes in the OWA ponds and potentially into the Feather River.

In addition, this measure should be coordinated with other potential sport fishery enhancements.

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**Resource Action: EWG-42**

**Task Force Recommendation Category: 2**

**RELEASE HATCHERY STEELHEAD EARLIER OR AT SMALLER SIZE TO REDUCE  
THEIR PREDATION ON JUVENILE WILD SALMON AND STEELHEAD**

**Date of Field Evaluation:** No field evaluation was conducted

**Evaluation Team:** Philip Unger

**Description of Potential Resource Action Measure:**

Feather River Hatchery (FRH) staff currently release all juvenile steelhead reared in the hatchery into the Feather River as yearlings. In contrast, FRH staff release all Chinook salmon production into the Sacramento/San Joaquin Estuary as young-of-the-year smolts. The FRH steelhead may spend a year or two in the Feather River before emigrating to the ocean, and in some cases may not emigrate at all. Yearling steelhead primarily feed on insects and other aquatic invertebrates, but older juvenile steelhead feed increasingly on small fish. The diet of these juvenile steelhead may include fry of wild origin salmonids, including Central Valley steelhead and Central Valley spring-run Chinook salmon, both listed as threatened species under the Federal Endangered Species Act. It has been observed that steelhead fry can become prey of older steelhead (SP-F3.2, Task 2; SP-F2, Task 1), and the same is likely true of salmon fry. Therefore, predation by FRH steelhead has a potential to reduce survival of wild salmon and steelhead. This measure would attempt to reduce this potential impact by modifying hatchery release practices for steelhead as follows:

- 1) Steelhead would be released earlier in the year, before wild salmon and steelhead have emerged from their redds, or
- 2) Steelhead would be released at smaller sizes, which are less likely to prey on fish, including salmonid fry.

**Related Resource Actions:**

There are several other Resource Actions that are either similar to or otherwise related to this measure:

- EWG-35A and EWG-35B are related to this action because they also address the resource goal of reducing predation on juvenile salmonids.
- EWG-40, is related to this action because it is designed to decrease hatchery production to reduce impacts on crowding in the lower Feather River.
- EWG-98, which is designed to provide additional instream habitat for juvenile steelhead and salmon.

**Nexus to the Project:**

This Resource Action is related to ongoing project operations and facility structures that impede or restrict passage of anadromous and migratory fish in the Feather River

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above Oroville Reservoir, and to practices of the FRH, which is an Oroville Project Facility.

**Potential Environmental Benefits:**

Little is known about predation of steelhead yearlings and older juveniles on salmonid fry, but such predation, if it is significant, has a potentially significant adverse effect on survival of wild salmonid fry in the lower Feather River. By reducing such predation, survival of wild-origin Chinook salmon and steelhead could be enhanced.

**Potential Constraints:**

The principal potential constraint on this measure is that there is little or no evidence to indicate that it would be effective in its overall goal of increasing the numbers of wild Central Valley steelhead and Central Valley Chinook salmon. There is also no evidence that predation on salmonid fry by the steelhead yearlings released by the FRH occurs in significant numbers. Another potential constraint is that changing the release timing or the size of the released juveniles could result in reduced survival of these fish and ultimately result in reduced numbers of returning adults.

**Existing Conditions in the Proposed Resource Action Implementation Area:**

The Feather River downstream of the Fish Barrier Dam provides approximately 16 river miles of rearing habitat for wild and hatchery origin Chinook salmon and steelhead fry. A few weeks after emigrating from their redds, salmon fry may move further downstream and may spend months rearing in the lower Feather River, the lower Sacramento River, the Yolo Bypass, and the Delta, before emigrating out to the ocean as smolts. During this period of rearing, the fry are preyed on by Sacramento pikeminnow, striped bass and other fish predators, possibly including resident trout and older steelhead juveniles. Young steelhead are likely to remain in the Feather River for much longer than juvenile salmon, and may not emigrate until their second or third year of life, or later. Particularly during their first year of life, the young steelhead are also vulnerable to predation by fish, which may include predation on fry by resident trout and older juvenile steelhead.

**Design Considerations and Evaluation:**

Evaluation of this measure should include predation studies of released hatchery steelhead. The focus of these studies should be predation on salmonid fry by different sizes of juvenile steelhead at different times of year. Results of such studies are needed to obtain evidence of whether or not this measure is likely to have any effect on survival of Chinook salmon or steelhead fry. If the results indicated that predation by released steelhead on fry was potentially significant, the results would then be used to determine the best time of year and best sizes of releases,

**Synergisms and Conflicts:**

This Resource Action is compatible with the resource goals of EWG-35A and EWG-35B, EWG-34 and EWG-41, which is to reduce predation on wild-origin Chinook salmon and steelhead fry.

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These reports are for discussion purposes only, and do not denote support by the EWG Collaborative.

**Oroville Facilities Relicensing Efforts  
Environmental Work Group  
Draft Narrative Reports for Resource Action Discussion**

The most important potential conflict from this measure is a potential reduction in the hatchery production of adult steelhead.

**Uncertainties:**

As noted earlier, the principal uncertainty related to this Resource Action is the significance on survival of Chinook salmon and steelhead fry of predation by steelhead released by the hatchery. Assuming such predation is significant, other uncertainties include the time of year that it has the greatest impact on survival of fry, and the range of sizes of the steelhead juveniles that prey on the fry.

**Cost Estimate:**

The Resource Action itself would likely have little cost, but the studies that would need to be conducted to determine its feasibility and how to implement it, would be very costly.

**Recommendations:**

There is little evidence that hatchery releases of steelhead significantly prey on Chinook salmon or steelhead fry. This action should not be adopted unless such evidence is produced.